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ABSTRACT

This study was designed to provide observations of the vocalizations and language of infants and young children and of changes in the subjects' pattern of play with toys, as well as their locomotor activity in a playroom. One hundred infants and children ranging from 10 months to five years of age were observed for two 15-minute periods, one with toys present and one with no toys in the playroom. The playroom was modified from a previous study on children's activity level development by replacing tables and chairs with braided rugs on the floor. The child's mother sat in a closet in the room with the door half open so her child could have access to her. Locomotor activity tended to rise from age 10 months up to a peak at 18-23 months; it then decreased from that age group to 24-29 months. Unexpectedly, after that age there was a steady increase with age in amount of activity up to five years. When toys were present, time spent in conventional play increased with age from 15 months up to four years; there were sex and age differences in preferences for particular toys. Vocalization and talking increased steadily with age. A discussion focuses on procedural differences between this study and the study by Routh, Schroeder, and O'Tuama (1974) which might account for the present findings a developmental increase in activity rather than a developmental decrease. (Author/SB)

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Development of Activity, Conventional Play, and Vocalization in Infants and Preschoolers

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PS008856

Running head: Activity, Play, and Vocalization

Abstract

One hundred infants and children ranging from 10 months to five years of age were observed for two 15-minute periods, one with toys present and one with no toys in the playroom. The playroom was modified from a previous study by replacing tables and chairs with braided rugs on the floor. A closet in the room was set up for the child's mother to sit in. Locomotor activity tended to rise from age 10 months up to a peak at 18-23 months; it then decreased from that age group to 24-29 months. Unexpectedly, after that age there was a steady increase with age in amount of activity up to five years. When toys were present, time spent in conventional play increased with age from 15 months up to four years; there were sex and age differences in preferences for particular toys. Vocalization and talking increased steadily with age. Discussion focused on procedural differences between this and the study by Routh, Schroeder, and O'Tuama (1974) which might account for a developmental increase rather than a developmental decrease in activity.

This investigation was planned as an extension downward into infancy of an earlier study of the development of activity level in children (Routh, Schroeder, & O'Tuama, 1974). It was designed to provide observations of the vocalizations and language of infants and young children and of changes in their pattern of play with toys, as well as of their locomotor activity in a playroom.

In the study by Routh et al. (1974) children between the ages of three and nine years were observed individually, without their mothers present, in a playroom. The room was divided into four quadrants by strips of tape on the floor, and each quadrant was furnished with a table, chair, and with toys appropriate to the broad age group studied, namely a marble pin-ball game, a toy car with friction motor, crayons and paper, an Etch-a-Sketch toy, and a Tinker toy set. Observations were made from behind a one way mirror of the frequency of line crossings and of toy switching during two 15-minute periods. A striking decrease with age was observed in the children's activity level. The younger children tended to walk and run around the room quite a bit, while the older ones tended to seat themselves at a table and engage in relatively inactive play. Subsequent research indicated that behavior in this identical situation significantly distinguished clinically hyperactive children from a non-clinic population matched for age, sex, IQ, and socioeconomic status (Routh & Schroeder, 1976).

If activity in such a playroom situation is steadily decreasing between the ages of three and nine years, one cannot help being curious about the activity levels of infants and children below age three. Obviously, from birth up to the onset of locomotion, infants would have zero scores for line crossing in such a situation. Our working hypothesis was that once locomotion began in the infant, locomotor activity should increase up to a peak (perhaps at age three, perhaps at some earlier age) and then begin the developmental decline seen in the Routh et al. data.

It was necessary, of course, to adapt the experimental situation so that it would be appropriate for the study of younger subjects. One change involved the presence of the mother. In the Routh et al. study, about one third of the three-year-old subjects had to be replaced because they became distressed while alone in the playroom. A subsequent study by Belkin and Routh (1975) indicated clearly that the presence of the mother in the playroom eliminated such distress for three-year-olds, in comparison to control conditions in which the child was either alone or in the presence of a male or female stranger. However, the presence or absence of the mother did not affect the child's activity level. It was also found that the children spent more time vocalizing (talking or singing) when the mother was present and would occasionally touch the mother but never a stranger. These behaviors are conveniently regarded as indices of attachment as described by Ainsworth (1964). What is known in general about attachment suggested that the presence of the mother would promote the easy adaptation of younger subjects in this situation. The physical arrangements which were worked out for the mother in the present

investigation were suggested by the work of Rheingold and Eckerman (1970) showing how an infant would leave the mother voluntarily in order to explore a new environment.

A second set of changes which were necessary concerned the toys and the furniture in the playroom. The toys used in the Routh et al. study were chosen for older children, and several of them seemed unsuitable for infants. The marble pin-ball game and car were made partly of metal and had sharp edges. The infants would probably try to put crayons in their mouths and might find the Tinker toys somewhat hazardous. We questioned, in fact, whether providing toys to the child had anything to do with the effects under study and introduced variation in the presence or absence of toys to test this. The tables and chairs in the Routh et al. study were of a size appropriate to older children and adults, so that an infant would not be able to sit comfortably in a chair or reach the top of a table.

Finally, some refinements in our behavioral coding system seemed desireable. The quadrant entry measure (Routh et al., 1974; Belkin & Routh, 1975) seemed suitable as the major dependent variable. The measures of toy play used in our previous work, however, did not seem sensitive to developmental changes. Thus, the present study defined a new measure of "conventional play" as a replacement for the previous tallies of toy-switching or measures of total duration of toy-contact. The vocalization measure used in the present study was simply an extension of that used in the Belkin and Routh study to include the unintelligible vocal sounds of infants as well as the talking and singing of older children.

Method

Subjects

The subjects were 100 infants and children ranging from 10 months to five years of age from the Chapel Hill, N.C. area. The subjects were divided into the following 10 age groups, with each consisting of 10 children (6 boys and 4 girls per group).

(1) 10-11 months (mean 10.7)

(2) 12-14 months (mean 12.6)

(3) 15-17 months (mean 15.4)

(4) 18-23 months (mean 21.4)

(5) 24-29 months (mean 27.2)

(6) 30-35 months (mean 32.5)

(7) 36-41 months (mean 37.8)

(8) 42-47 months (mean 44.0)

(9) 48-59 months (mean 54.2)

(10) 60-71 months (mean 65.3)

No child with a gross sensory or motor defect or a known neurological abnormality participated. The median education of the children's fathers was a graduate or professional degree, and that of the mothers was a standard undergraduate degree. In terms of the Hollingshead (Note 1) Two-Factor Index of Social Position, the mean for these families was 21.1 (upper middle class), with a standard deviation of 12.1. Of the 100 infants and children, 91 were white and 9 were black.

Apparatus

The same playroom was used as in previous studies, but with certain modifications as noted below. Each quadrant of the room contained an oval

braided rug on the floor, approximately the same size as the tops of the tables in the Routh et al. (1974) study, and centered within the quadrant. On each rug the following toys were laid out from left to right: 20 wooden alphabet blocks, with the letters or numbers up, arranged in a 5-by-4 matrix; foam rubber toy car (Parker Nerf-mobile, "The Bug"); Raggedy Ann or Raggedy Andy doll; Etch-a-Sketch toy; and a stack of 11 plastic colored rings of graduated size on a tapered spindle (Fisher-Price Rock-a-Stack).

A place for the mother to sit was arranged in a small closet which opened onto the playroom. A chair was provided in the closet, plus a current newsmagazine and a duplicate of the set of instructions which had been read to the mother. One of the two vertical halves of the door from the closet into the playroom was anchored in an open position, and the other half was closed and locked. The effect of these arrangements was that the observers behind the one-way mirror could see the mother clearly, but the child could see her only by going into the closet or by standing immediately in front of the open half door.

Procedure

Each child was observed for two 15-minute sessions, one with toys present, the other with no toys on the rugs. The sequence of conditions (toys, no-toys; or no-toys, toys) was counter-balanced, with 50 children randomly assigned to each sequence within the constraints of age and sex subgroups.

The mother and child were greeted by the experimenter, and the following instructions were read aloud to the mother before the pair

were taken into the playroom for the first time:

> In a few moments you and your child will be taken into a playroom. We are interested in what the child finds to do in this room and will observe what he or she does during two 15-minute sessions, one session with toys in the room, the other with no toys (some children will be observed with no toys first and then with toys second). We like to have the child's mother near where the child is to prevent any possible distress. Therefore we have arranged a special place for you to sit in a sort of a closet with a door always open into the playroom. You will begin each session by taking your child into this closet with you and sitting down. When you hear a knocking sound, this is a signal that we are ready to begin. At this point put your child on the floor in front of you or let go of his or her hand. Please stay seated all during the session. You will have a magazine which you may read if you like. If your child stays with you for a while or wants to be in your lap, this is OK. However, do not start any conversation or game with your child. Respond naturally to what he or she does. You can smile, answer questions, or what not as long as you are following the child's lead. If your child ventures out into the playroom, let him or her go and do not try to look around the door at him or her. If the child wants to leave the room before the 15 minutes is up, say "not now." At the end of each 15-minute session, one of us will enter the room and tell you that the session has ended.

Between sessions, the mother and child were taken to an office in another part of the building, where the mother filled out a personal data questionnaire.

The instructions for the second session were, "Now we will do the same thing once more. This time the toys are [there/gone]."

Observational Measures

All dependent measures were continuously recorded by two observers sitting behind a one-way mirror, using a 20-pen Esterline Angus event recorder. Inter-observer reliabilities were calculated for each measure (Pearson product-moment correlation coefficients), and all of these were .98 and above. The definitions of the direct and derived measures were as follows:

1. Time in the playroom. Usually 15 minutes (900 sec.) unless child cried or protested vociferously, in which case the session terminated early.

2. Time before child initially left the mother. Defined as crossing completely the line of black tape on the floor at the threshold of the closet.

3. Time with mother. Defined as time spent with any part of the child's body within the closet.

4. Time in near quadrant. Defined as time spent with any part of the child's body within the quadrant of the room adjacent to the closet.

5. Time spent vocalizing. Vocalizing was considered to include talking, singing, humming, whistling, and unintelligible vocal sounds made by the child.

6. Time spent vocalizing with mother. That part of time spent vocalizing when the child was with mother as defined above.

7. Quadrant entries, as defined by Routh et al. (1974).

8. Trips to mother's cubicle. Defined as the number of times the child traversed the line at the threshold of the closet where the mother sat.

The eight measures defined above could be considered general measures,

in that they could be recorded for both sessions. The other six measures are considered toy measures, in that they were applicable only to the session with toys present in the room:

9. Time touching blocks.

10. Time touching car.

11. Time touching doll.

12. Time touching Etch-a-Sketch.

13. Time touching Rock-a-Stack.

14. Time spent in conventional play with any toy. This last measure requires some elaboration in definition. Basically, conventional play was defined as using a toy for the purpose for which it was designed, as this purpose would be understood by an older child or an adult. The activities which we have come to consider conventional for each of the toys provided were as follows: (a) blocks: building a structure; knocking down a structure; playing any sort of game with a block structure; counting, sorting, or naming colors or letters on the blocks; or arranging the blocks in any design. (b) car: pushing or rolling the car on the floor. (c) doll: any make-believe play in which the doll is treated as a person; holding or carrying the doll would be considered conventional play only if the doll were held in the manner in which one would carry a baby. (d) Etch-a-Sketch: turning the knobs to make a design, shaking the toy to erase a design. (e) Rock-a-Stack: taking the rings off the stack or putting them back on, rocking the toy, naming the colors of the rings, sorting the rings according to size or color.

Results

Since, as indicated below, children in the different age groups spent varying amounts of time in the playroom before causing the termination of a session by crying or protesting, all of the other time measures were expressed as proportions of the total time each child spent in the playroom, and all frequency measures were expressed as rates per 15 minutes. Also, in order to normalize the distributions, all time measures were subjected to an arc sine transformation before analysis.

General Measures

A multivariate analysis of variance was carried out on the general measures to assess the effects of age, sequence of experimental conditions, and presence of toys. A preliminary analysis indicated no main effects of sex and no interactions of sex with other variables with respect to the general measures. Thus, the reported analyses of these variables pooled subjects without regard to sex.

The multivariate analysis indicated, first of all, a significant overall effect of age (F=1.639, df=72/452, $p < .002$). A subsequent univariate analysis of variance indicated significant age differences in activity level as measured by quadrant entries per 15 minutes (F=2.467, df=9/80, $p < .02$). This effect is shown in Figure 1. Figure 1 indicates

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Insert Figure 1 about here

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that the rate of locomotor activity tended to rise from age 10 months up to a peak at 18-23 months; it then decreased from that age group to 24-29 months. Unexpectedly, after that age there was a steady increase with age in the rate of activity up to five years. There were also

significant main effects of age on time in the playroom and time spent vocalizing, but since these effects were modified by interactions with the presence or absence of toys, the findings will be presented below.

The sequence of experimental conditions did not have a significant multivariate effect on the general measures.

The presence of toys did have a significant multivariate effect (F=175.520, df=8/73, $p < .001$). Subsequent univariate analyses indicated that the presence of toys affected all of the general measures except activity level (quadrant entries). That is, when toys were present, children stayed longer in the playroom without protest; left the mother more quickly to enter the playroom; spent less time with mother, less time in the near quadrant, less time vocalizing, less time vocalizing with mother; and made fewer trips to the mother's cubicle, as compared to the condition with toys absent.

Of the interactions of the three independent variables, only the one involving age and the presence of toys had a significant multivariate effect (F=1.382, df=72/452, $p < .03$). One measure which was involved in this interaction was time in the playroom (univariate F=2.159, df=9/80, $p < .04$). As shown in Figure 2, when toys were present in the room, there

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Insert Figure 2 about here

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was only a slight tendency for younger children to cause the session to be terminated by crying or protesting. When the toys were absent, this tendency was greatly accentuated in the younger children, especially the 15-17 month age group. As mentioned above, these differences in time in the room would greatly affect every measure, and this was the reason the other measures were transformed into proportions of the time each

child spent in the room, before the analysis reported here.

The only other measure involved in the interaction of age and the presence of toys was time spent vocalizing (univariate $F=2.948$, $df=9/80$, $p<.004$). As Figure 3 shows, in the session with toys present, there was

Insert Figure 3 about here

a regular, almost perfectly monotonic increase in the amount of vocalization with age. The 10 month olds vocalized for only about 10 percent of the session, whereas children three and a half or older vocalized about 30 percent of the time. In the session with no toys present (now shown), the nature of the age differences was less regular. There was a trend toward an unverted-U shaped curve, with the youngest and oldest groups vocalizing less than children of intermediate age.

Toy Measures

The multivariate analysis of variance of toy measures assessed the effects of age, sex, and sequence condition (toys present in 1st or 2nd session) on the dependent measures of time in the playroom, total time touching any toy, conventional play, and time touching each of the five toys provided.

The multivariate effect of age on toy measures was significant ($F=2.173$, $df=72/452$, $p<.001$). There was a significant univariate effect of age on conventional play ($F=13.010$, $df=9/80$, $p<.001$), the nature of

Insert Figure 4 about here

which is shown in Figure 4. As Figure 4 indicates, conventional play was practically nonexistent in infants from 10 to 17 months old. The proportion of the session devoted to conventional play then rose steadily

with age to a peak in the 48-59 month olds, and decreased somewhat in the five year old children.

Age also had a significant effect on the proportion of time spent touching two of the toys provided. Younger children spent a higher proportion of their time in contact with the Rock-a-Stack than did older children (F=2.149, df=9/80, $p < .04$). In contrast, older children spent a higher proportion of their time in contact with the Etch-a-Sketch than did younger children (F=2.461, df=9/80, $p < .02$). However, there was not a significant age effect on the total time spent in contact with the five toys, considered collectively, nor with any of the other three toys provided.

The multivariate main effect of sex on the toy measures was significant (F=2.992, df=8/89, $p < .005$). The only dependent measures involved in this sex effect were time spent in contact with two of the toys, namely the car and the doll. Boys spent a higher proportion of the session than girls in contact with the toy car (F=6.715, df=1/96, $p < .02$), while girls spent a higher proportion of the session in contact with the doll (F=5.838, df=1/96, $p < .02$).

There was not a significant effect of sequence condition on the toy measures, nor were there any significant interactions in the analysis of these measures.

Discussion

This study began as an attempt to extend downward into infancy the findings of Routh et al. (1974) of a decrease with age in children's activity levels. Thus, the finding of an increase in quadrant entries between the

ages of 24 months and five years in the present study came as a surprise and requires new recognition of the part played by situational context in controlling children's activity. One cannot state flatly that there is either a decrease in activity with age or an increase in activity with age, without specifying the particular circumstances under which the child is observed.

Why were the results of the Routh et al. (1974) study and the present one so divergent? Three variations in methodology present themselves as logical explanatory possibilities: (1) presence of the mother, (2) change in the toys provided, and (3) removal of the tables and chairs from the playroom. There is some evidence from the Belkin and Routh (1975) study that the presence or absence of the mother would have little impact on the child's locomotor activity. The toys used in the present study were indeed selected to be of greater interest to infants and younger children. In the case of one toy, the Rock-a-Stack, there was significant evidence of relative disinterest on the part of the older children in this study. Perhaps, then, the four and five year olds moved about the room because they found that the toys lacked interest or challenge. If a child did decide to run around the room, it is clear that the older children would be able to run faster. The most plausible hypothesis, however, relates to the removal of tables and chairs from the room. Given the hindsight provided by the present study, one might reinterpret the findings of Routh et al. (1974) as follows: the presence of tables and chairs suggested, especially to the older children, that the experimenter considered quiet play seated at a table the behavior appropriate to the situation. Younger

children, and hyperactive children as well (Routh & Schroeder, 1976) failed to be influenced so much by this demand characteristic of the situation. In any case, it is an empirical question which of the three methodological variations was responsible for the different findings, and a study is currently underway in our laboratory to answer it.

A second finding, this time not an unexpected one, was that the presence of toys in the playroom had an effect on several of the dependent measures. When toys were present, they seemed to interest the child enough to reduce the amount of interaction with the mother. Thus, when toys were in the room, the child left the mother more quickly, spent less time and made fewer trips to be near her, and vocalized less. These general findings are in line with the principle established by Rheingold and Eckerman (1970) that an infant will voluntarily leave the mother in order to explore an interesting environment. They are also consistent with the finding of Corter, Rheingold, and Eckerman (1972) that the presence of a toy will delay an infant's following of the mother. However, as noted above, the presence or absence of toys seemed to have little to do with the child's activity level in this situation.

The tendency of children in this study to become distressed, as indexed by crying or protesting, was related both to the age of the child and the presence of toys in the room. The tendency of younger children to become distressed in this playroom had already been noted in the Routh et al. (1974) study (among three year olds only). Belkin and Routh (1975) found that such distress could be completely prevented by the mother's

presence in the room. Now, in the present study, the phenomenon of distress emerged once more, particularly in children younger than three but also in a few children as old as three or four years. Distress in these infants and young children was clearly related to the presence or absence of toys, and thus does not seem particularly in need of special explanation.

A striking finding of the study was the regular developmental increase in vocalization in the situation with toys present. It will be recalled that the vocalization measure was included mainly because a similar measure had been found to be productive in the Belkin and Routh (1975) study. Although vocalizations, in the sense of unintelligible infant sounds, have long been studied, there have been no attempts known to the present authors to trace the development of vocalization and speech over the age span covered here. Lewis (1936, 1959) did present a general account of how vocalizations and language develop in the infant, including three stages: (1) from birth to three or four months of age, when the infant engages in vocal play and vocalizes in response to the speech of others, (2) a period when this vocal response to speech seems to disappear almost entirely, and (3) a stage beginning after 10 months of age when a renewed response to speech develops, including imitation of the speech of others. Jones and Moss (1971) found that infants vocalized more at three months of age than at two weeks of age. Roe (1975) studied the vocalizations of infants from three to nine months of age and found, as Lewis's theory might suggest, high rates of vocalization under stimulation at three and five months, a low point at nine months, and an increase again at around 11 months of age. The present study would seem to extend the findings of these

infant vocalization studies to older children, showing that at least under some conditions, vocalizations continue to increase in quantity from 10 months up to around three and a half years of age, where the quantity seems to stabilize.

The remaining findings to be discussed concern the toy measures. It was hardly surprising to find that the age and sex of the children were reflected in certain toy preferences. Nor were we surprised to find that the total time in contact with the toys was not a productive measure. We had tried such a measure out in some previous research with both normal and hyperactive children and had never found it to be a satisfactory index of the elusive concept of "attention span." The measure of "conventional play" developed in the present study, however, seemed to be a promising one in that it showed clear, systematic developmental change, at least over the age range from 18 to 59 months. The infants younger than 18 months did not actually seem as concerned as the toddlers with whether toys were provided at all and seemed to find features of the room such as door knobs and the strips of tape on the floor of equal interest. Their repertoire of behaviors with toys was simple, consisting of such responses as picking up, mouthing, shaking, carrying around, and throwing the toys. The five year olds apparently became disinterested in the toys which were provided them, although we know well from other studies that this age group is capable of quite prolonged sustained attention with other toys such as crayons and Tinker toys. In the present study, for reasons which are not entirely clear, these older children apparently preferred running around the room to spending so much time in play with toys.

In conclusion, the present study found an increase rather than a decrease with age in the locomotor activity of preschool children in a playroom, thus indicating the importance of situational context in understanding activity. The presence of toys prevented distress and reduced the children's interaction with the mother but did not seem to affect activity. The regular increase in vocalization which was found extended the findings of previous studies from infancy up into the preschool ages.

Reference Note

1. Hollingshead, A. B. Two-factor index of social position. Unpublished manuscript, 1957. (Available from A. B. Hollingshead, 1965 Yale Station, New Haven, Connecticut).

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Footnote

1. A preliminary version of this article was presented at the meeting of the American Psychological Association, Washington, D. C., September 4, 1976, as part of a Symposium on Developmental Aspects of Hyperactivity. The assistance of Susan Foreman, Doris Kistler, and Marsha Walton is acknowledged. This research was supported by U. S. Public Health Service, Maternal and Child Health Project No. 916 and by Grants HD-03110 and ES-01104. Requests for reprints should be sent to Donald K. Routh, Division for Disorders of Development and Learning, University of North Carolina, Chapel Hill, North Carolina 27514.

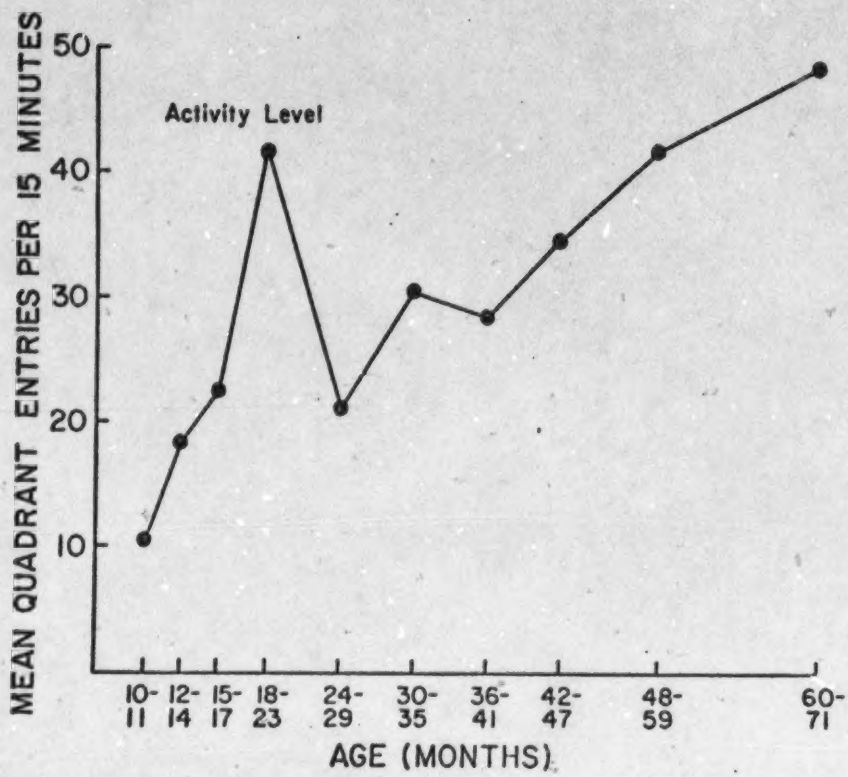
Figure Captions

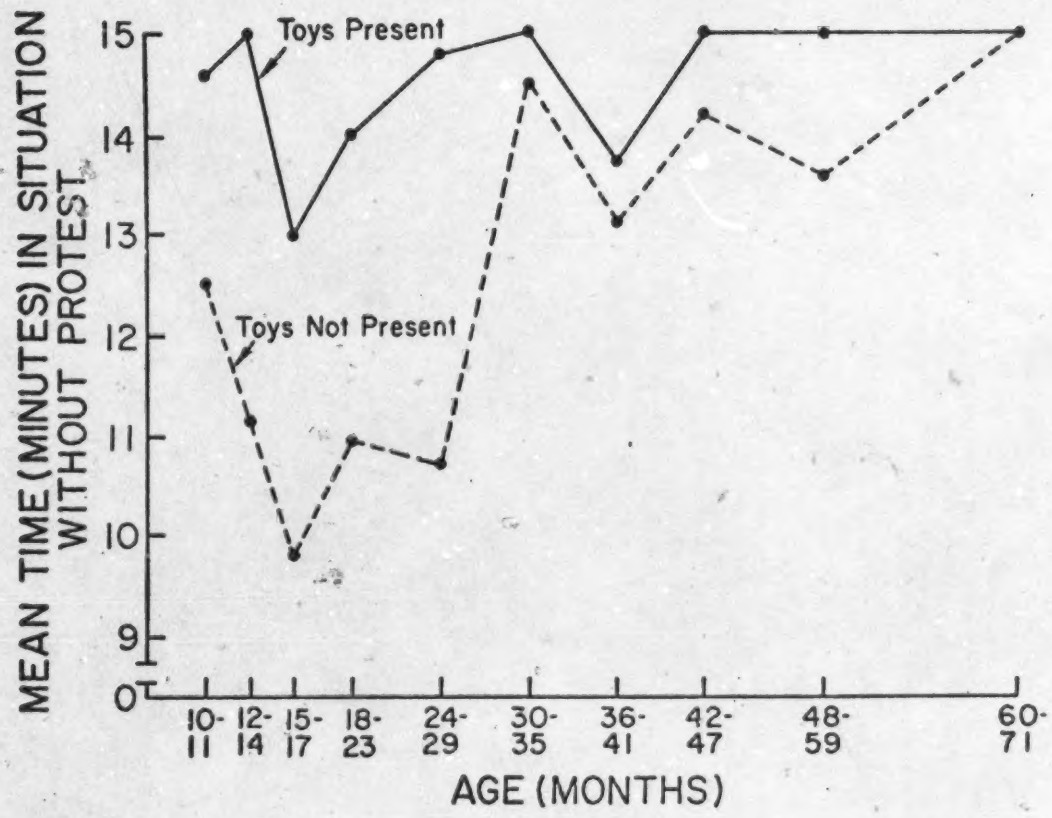
Figure 1. Relation of activity level (rate of quadrant entries/15 minutes) to age.

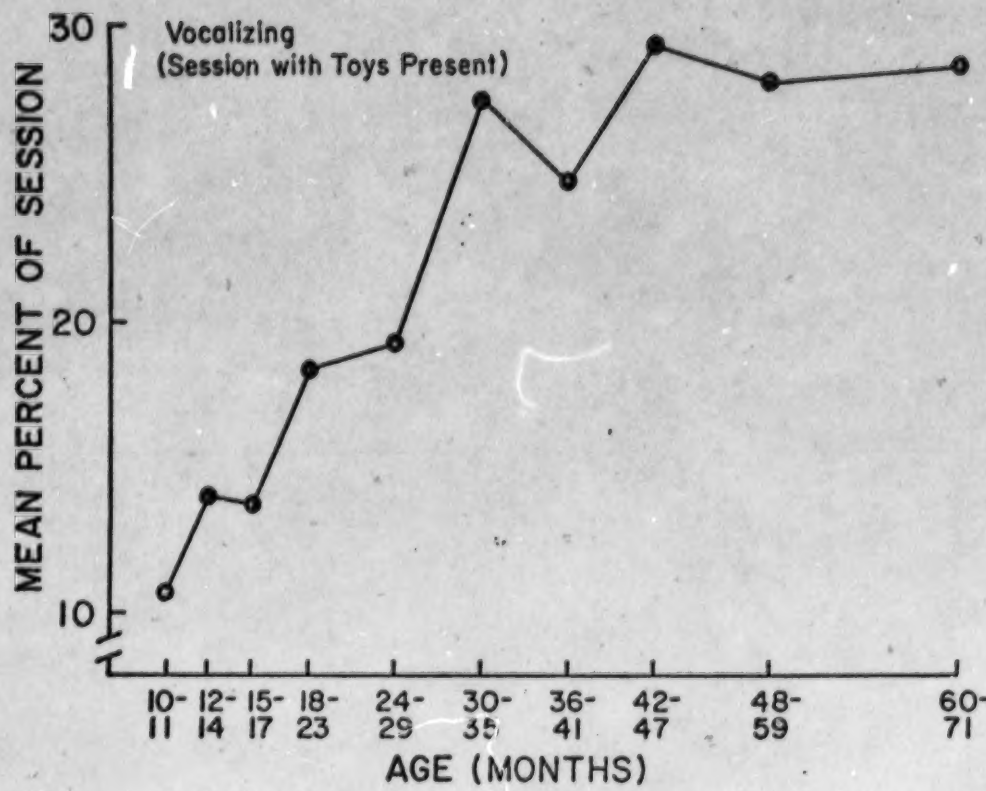
Figure 2. Relation between time in playroom before any crying or protest and presence of toys for infants and children of different ages.

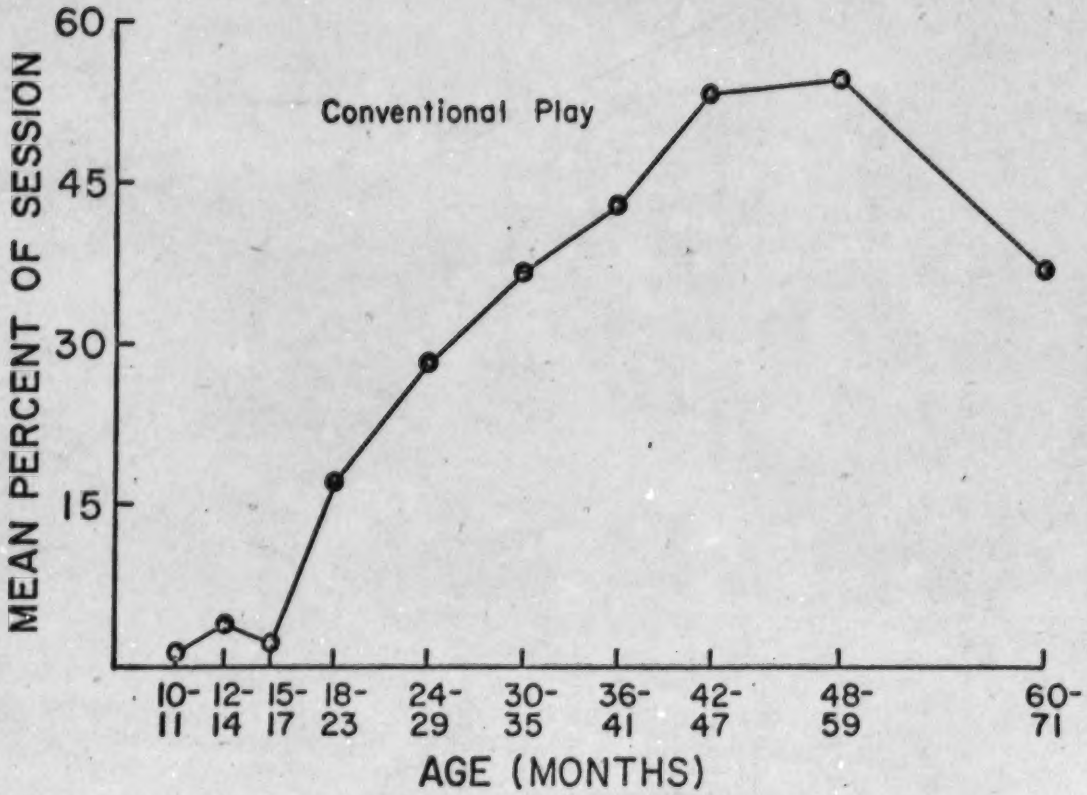
Figure 3. Proportion of session spent vocalizing as a function of age. Session with toys present only.

Figure 4. Relation of conventional play to age.


Activity Level
MEAN QUADRANT ENTRIES PER 15 MINUTES
50
40
30
20
10
10-11
12-14
15-17
18-23
24-29
30-35
36-41
42-47
48-59
60-71
AGE (MONTHS)


MEAN TIME (MINUTES) IN SITUATION WITHOUT PROTEST
15
14
13
12
11
10
9
0
Toys Present
Toys Not Present
10-11
12-14
15-17
18-23
24-29
30-35
36-41
42-47
48-59
60-71
AGE (MONTHS)


Vocalizing
(Session with Toys Present)
MEAN PERCENT OF SESSION
30
20
10
10-
11
12-
14
15-
17
18-
23
24-
29
30-
35
36-
41
42-
47
48-
59
60-
71
AGE (MONTHS)


60
45
30
15
MEAN PERCENT OF SESSION
Conventional Play
10-11
12-14
15-17
18-23
24-29
30-35
36-41
42-47
48-59
60-71
AGE (MONTHS)